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ABSTRACT

The need for teacher level administrative tasks is identified. One solution offered is Computer Managed Instruction with a review of the literature and a model showing teacher, computer, and student interaction. A chart of important criteria for evaluating Computer Managed Instructional Systems is supplied. After synthesizing conclusions, some recommendatons are made along with future directions of Computer Managed Instruction. (A substantial bibliography concludes the paper.) (Author)

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COMPUTER MANAGED INSTRUCTION

AND

TEACHER LEVEL ADMINISTRATION

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ABSTRACT

The need for teacher level administrative tasks is identified. One solution offered is Computer Managed Instruction with a review of the literature and a model showing teacher, computer, and student interaction. A chart of important criteria for evaluating Computer Managed Instructional Systems is supplied. After synthesizing conclusions, some recommendations are made along with future directions of Computer Managed Instruction.

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PART I. INTRODUCTION AND IDENTIFICATION OF THE ADMINISTRATIVE PROBLEM

According to (Spuck and Owen,1975) Education has always been under criticism and pressure from society to keep up with the current 'high technology' revolution. Presently, it seems that microcomputers in education are the focal point of concern. One theme, aimed at improving the teaching and learning processes is termed as 'individualized instruction.' According to educators that promote individualized instruction, attention should be directed to the need and ability of the individual learner instead of the whole group. Research done by people such as (Klausmeier,1971),(Flanagan,1971), and (Cooley and Glasser,1968) has shown that this approach is successful. But, according to (Spuck and Owen,1975), the following quotation summarizes a major problem that is encountered by teachers that use individualized instruction:

> "Essential to the functioning of such programs of individualized education is the teacher's ability to cope effectively with the large volume of information required in the management of these programs. Due to the fact that differing insructional stategies may be used at differing times with large numbers of students, monitoring the programs of students and deciding upon optimal instructional objectives and tasks becomes an extremely complex and difficult endeavor. This condition is compounded as more areas of the educational program are individualized."[1].

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[1].Dennis W. Spuck and Stephen P. Owen,"The Structure and Management of Individualized Instruction",Paper presented at the Annual Meeting of the American Educational Research Association (Washington,D.C.,March 30 through April 3, 1975).

Furthermore, (Brown et al,1980) carried out a research study because Alberta Education was worried about the increasing time factor that was demanded from teachers for the non-teaching segment of their teaching day (levels: Kindergarten to Grade 12). All of the teachers questioned agreed on the five most aggravating non-teaching tasks as: 1. Test Construction, 2. Assistance in the Development of Learning Materials, 3. Assigning and Marking Tests, 4. Student Progress (Tracking), and 5.Test Analysis. The researchers suggested a C.B.I.S. (Computer Based Instructional Support) system with three options: 1. Centralized, 2. Partially Decentralized, and 3. Totally Decentralized. These three options also reflected the three levels of access to student records (provincial access, provincial and teacher access, and teacher access only).

Therefore, at the teacher level, there is a great need for some type of computerized system to help alleviate the teacher's burden of extra administrative bookkeeping that is inevitable when individualized instruction is utilized. In addition to individualized instruction, a teacher can also surely use some help in the above 'five most aggravating non-teaching tasks.'

PART II. ANALYSIS AND LITERATURE REVIEW

The most precise overall general definition of CMI (Computer Managed Instruction) is from Europe. Leiblum,(1982) from the University of Nijmegen, Netherlands explains and translates a Dutch definition from their V.O.C. journal:

> ... "in computer-managed instruction the computer performs various management tasks related to individualized study courses. This management responsibility includes: handling entrance level testing and testing related to student progress during a course; the reference of students to instructional material found outside the computer based students performance on a test; and finally the handling of a final examination. By performing these tasks not only is feedback to the student possible but also information is given to the instructor concerning individual student progress. By the computer's handling of a final examination, the instructor can obtain a broad overview of both individual and group performance. Because reliable and detailed records are available, an evaluation of the educational process (system) is more practicable. Instructional materials are typically found external to the computer. Use is often made of existing materials, books, lecture notes or even traditional class lectures or seminars supplemented by study guides and printed exercises."[2].

Also as far as this paper is concerned, all of the following acronyms refer to the topic of this paper (Computer Managed Instruction) or have the same overall meaning: CML (Computer Managed Learning), CAL (Computer Assisted Learning), and CBI (Computer Based Instruction) which is a broader term. More specifically, CML refers to a student's rate of progress monitored by a computer. All or a portion of the instruction may come via the computer. CAL is the learning acquired by a student with all or a portion of the instruction coming via the computer. CBI refers to the concept that most or all of the instruction comes via the computer. It is a broader term because it may encompass CMI, CAI, CAL, and CML. There are no universally defined definitions that are used by all 'computer literates'.

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[2]. Mark D. Leiblum, "Computer-Managed Instruction : An Explanation and Overview", AEDS JOURNAL, VOL.15, NO.3, (SPRING 1982), 129-130.

Usually, when one uses one of these terms, it is necessary to explain exactly what one means by defining the term in the context that it is used in. CAI (Computer Assisted Instruction) is not the same as CMI! CAI may or may not include some type of management program to keep track of the student's progress. CMI also may or may not include CAI as defined by (Leiblum,1982) above.

The definition found or used in the American literature on CMI is usually evolved around three main components. According to (Baker,1978), the three labels he uses are: 1. Individualization, 2. Behavioral Objectives and 3. Educational Technology. Individualization refers to the student's interest, learning style (inductive/deductive/discovery/etc.), learning mode (print,lecture,audio/visual,etc.), rate of progress and other factors such as I.Q., age, sex, and environmental conditions. Behavioural Objectives refer to the task analysis/breaking down of a course or curriculum specified into particular objectives. These objectives are then used in test formation and to check the mastery level or level of attainment reached by the student. Educational Technology is the combination of hardware and software at a particular point in time that is available for use in a complete CMI system (can also be considered as the limiting factor of CMI, as to what is possible and what is impossible).

The following table ("Table 1 Computer-Managed-Instruction Elements") from (Leiblum,1982) summarizes the most important functions associated with CMI systems:

"Table 1

Computer-Managed-Instruction Elements"[3].

GROUP 1:

"1. Objective Banking.
The collection and maintenance of a structured set of objectives related to a lesson, task, a course, a discipline of curriculum.

2. Learning Resources Banking and Library Information Retrieval.
The collection and maintenance of structured lists of educational facilities/resources/packages and/or library information retrieval system (just books or printed materials).

3. Learning Material Banking.
The collection and maintenance of instructional materials (a learning resource center) limited to those types which can be stored in computer hardware/software of peripheral units.

4. Item Banking.
   a. Collection of a structured set of items.
   b. On-line editing of items.
   c. Maintenance of item statistics.
   d. Maintenance of bank usage statistics."[3].

GROUP 2:

"5. Item Generation.
   a. Generation of items via a framework or macro facility, e.g. random number generation.
   b. Generation of items through randomly selecting/substituting existing parts of the item (stem of answer choices).
   c. Generation of items based on a model/grammar representing the structure of the learning materials.

6. Test Generation.
   a. Allocating items for individual study quizzes.
   b. Generating parallel forms of a specific quiz.
   c. Generating standardized final examinations from an item bank.

7. Assessment.
   a. Scoring of individual quizzes.
   b. Scoring of final examinations.

8. a. Reporting (usually in printed form) of individual study results (tests).
   b. Reporting of individual and group study progress.

9. Evaluation.
   a. Providing test analysis.
   b. Providing educational product analysis (formative evaluation).
   c. Providing educational process analysis, e.g. information about study time, intervals between attempts, number of attempts, questionnaire processing, etc."[3].

GROUP 3:

"10. Assignment.
Assignment tasks (e.g. homework) based on objectives or study results.
11. Counseling.
Providing individual advice relating to study goals.
12. Scheduling.
Creating and maintaining schedules of educational facilities, e.g. of manpower or physical/ instructional resources."[3].

Leiblum.(1982) states that from the above table of CMI functions, at least one function from each of the following three groups must be present for a software/courseware package to be called or labelled as a CMI system: Group 1.: (functions 1,2,3,4), Group 2.: (functions 5,6,7,8,9), and Group 3.: (functions 10,11,12). An example of a CMI system that would fit into Leiblum's definition is the "Milliken Computer Courseware Math Sequences". This software package and other "Milliken Courseware Packages" are available from local software distributors and are currently being used in some lower mainland school districts. He also clearly states that CBT (Computer Based Testing) and record-keeping programs by themselves are not CMI.

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[3]. Mark D. Leiblum, "Computer-Managed Instruction : An Explanation and Overview," AEDS JOURNAL, Vol.15, No.3, (Spring 1982), 131.

CAI is not CMI. Some CAI program packages have CMI integrated with them, but according to (Leiblum,1982) the CMI part must have at least one function from each of his three groups to qualify as a 'true' CMI system.

Dean and Whitlock,(1983) suggest that along with the functions listed by (Leiblum,1982), a sophisticated CMI system should also have the capability to record: (a.) Starting and finishing dates and times of each unit /module of CAI, (b.) All responses given by the student (right and wrong ones), (c.) All video 'frames' that the student passed through, and (d.) The specific remote terminal (if the student was using a networking system). This extra information available to the instructor would help to pinpoint exactly where the students were having difficulties. These authors supply a valuable listing and description of twelve CMI systems and their respective compatible computer hardware.

Orwig,(1983) states that CMI used in conjunction with a microcomputer system is quite limited in flexibility. He points out that the greatest difficulty is writing or finding a software package that can be: (a.) accommodating to the varying needs of the students and (b.) the accompanying varying instructional materials that are required to meet these changing needs.

Ragsdale,(1982) recommends that a CMI system should have a 'record-keeping database' on independent CAI packages. This means that when a student is using a CAI package in any subject area (ie. Mathematics, Chemistry, Physics, etc.), the student's progress records of each subject would be kept in a commmon

database. This database would also be accessible to teachers, principals, and school board level administrators. He points out that caution should be taken to the areas of: security, inter-school board and inter-school networking systems, and flexible databases that would accommodate very easily changes made to student records and curriculum in each subject.

The following model/ 'Figure 1' is from (Leiblum,1982), which gives a clear relationship among the student, the computer, and the teacher.

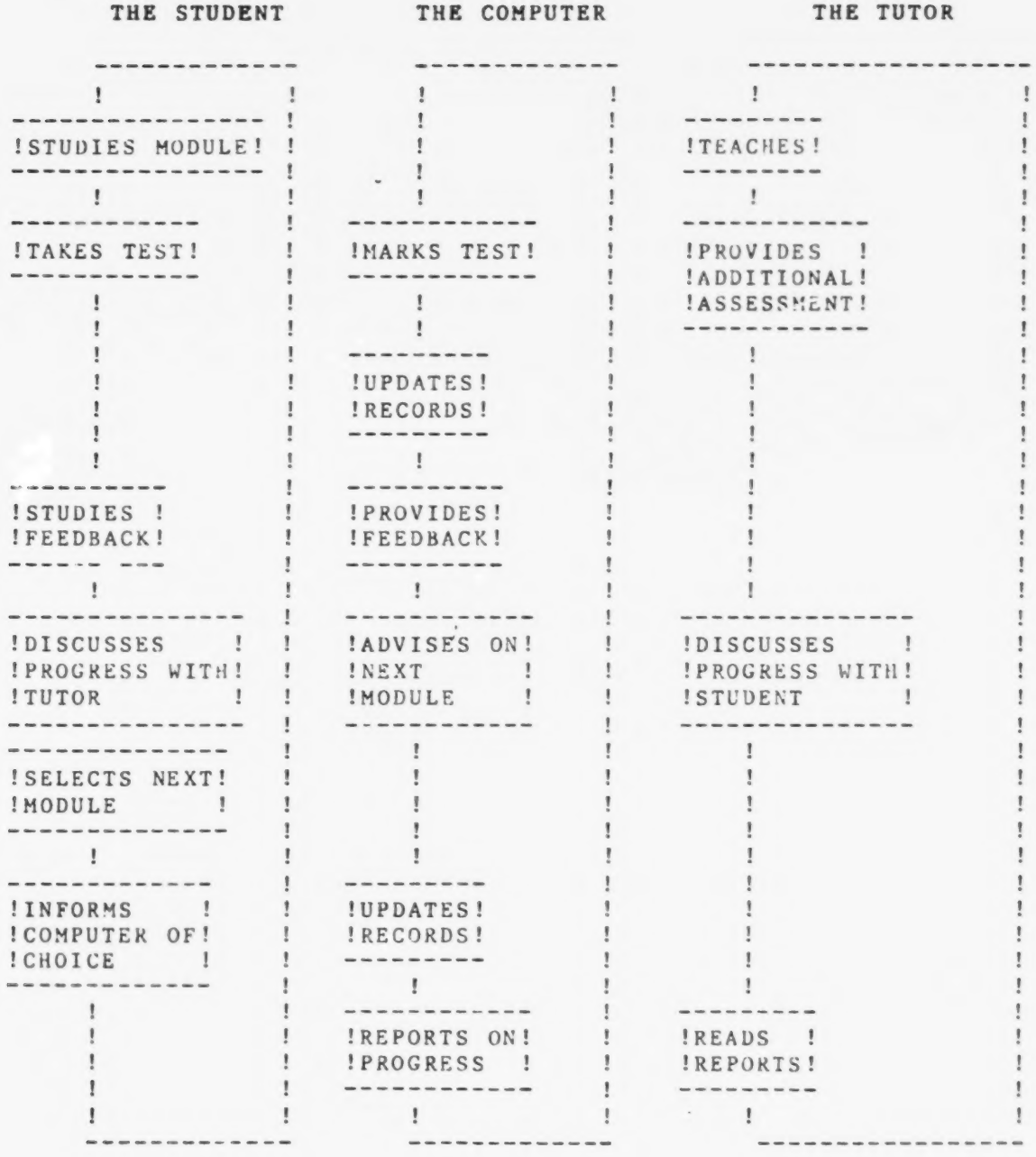

Figure 1. General Model of Computer-Managed Learning.[4]

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[4] Mark D. Leiblum, "Computer-Managed Instruction : An Explanation and Overview", AEDS JOURNAL, Vol.15, No.3, (SPRING 1982), 137.

An important issue raised by (McCann,1981) is based on the educational philosophy and learning strategy related to CMI. He raises the question about where the learning control should be. Should it be with the student or with the computer? He points out that some CMI adapts the instruction for the student based on previous information acquired (through pretests, post tests, past performance, etc.). A fear is that the student may become dependent on similar CMI systems for learning but the real world is definitely not that adaptive! Will the student be able to survive outside of a high level CMI learning system?

Some of the administrative needs at the principal level are: to know the rate of progress of students, the teaching rate of teachers, generation and distribution of report cards, and attendance. Teachers that use CMI systems integrated with CAI or CMI 'stand-alone' systems can make it very easy for the principal to access records for specific students, courses, and teachers via a terminal located in the office. Principals can also gather data very easily and quickly on other aspects that they require.

Now that we have knowledge of the European and American definitions of CMI systems and we have considered other researcher's viewpoints and criticisms, how do we actually evaluate a CMI system? The following table ('Figure 3. Evaluation Framework for a CMI') from (Spuck and Bozeman,1980) gives the 'Dimensions' and 'Levels' that should be considered when evaluating a CMI system:

DIMENSIONS / LEVELS	FUNCTIONAL Are the various subsystems of the MIS program, both human and physical, capable of operating or functioning in accordance with design specifications?	EFFECTS What results are achieved from the utilization of the system, and are the objectives of the system being met?	UTILIZATION For what management processes is the system being employed, and is the use of the system consistent with those uses specified in the design?
ACTUAL Objective and/or quantifiable information from primary source	1. Computer software testing 2. System response time 3. Required hardware available 4. Appropriate user interfaces (e.g., error messages) 5. User knowledge of system operations 6. System availability 7. User documentation and training materials	1. Number and type of system accesses 2. Uses of system reports 3. System responsiveness	1. Student achievement 2. Teacher time usage 3. System cost and cost effectiveness 4. Changes in roles and tasks
PERCEPTUAL User descriptions and awareness of system operations and effects	1. Need for MIS perceived by user 2. Perceived level of administrative support	1. Descriptions of usefulness of system reports 2. Appropriateness of reports	1. Descriptions of impact on achievement 2. Perceptions of system

		3. System responsiveness	
ATTITUDINAL User conclusions about value or benefit of the system	1. Initial apprehension or anxiety 2. Potential utility 3. Personal commitment	1. Confidence in system accuracy and reliability 2. Feelings concerning system usability	1. Desirability of system effects 2. User satisfaction impact on decision making

Figure 3. Evaluation Framework for a CMI[5].

This chart of checklists is valuable not only for evaluating a commercially produced CMI system but also if you are planning to design and produce your own CMI system. Educators and teachers must not become solely dependent on CMI systems but also keep an overall evaluation scheme in mind when teaching. This evaluation scheme can be summarized by the following five statements from (Bloom et al,1971):

> "1. Acquiring and processing the evidence needed to improve the students learning and the teaching.
>
> 2. Employing a great variety of evidence beyond the final paper and pencil examination.
>
> 3. Clarifying the significant goals and objectives of education and determining the extent to which the students are developing in these desired ways.

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5. Dennis W. Spuck and William C. Bozeman,"A Design for the Evaluation of Management Information Systems",AEDS JOURNAL,VOL.14,NO.1,(FALL 1980),41.

4. Instituting a system of quality control in which it may be determined at each step in the teaching-learning process whether the process is effective or not and if not, what changes must be made to insure effectiveness.

5. And, ascertaining whether alternative procedures are equally effective or not in achieving a set of educational ends."[6].

PART III. SYNTHESIS/CONCLUSION

After looking at the review of the literature, there seems to be many interpretations of CMI by the leading researchers in the field of computers in education. The important objectives accomplished by an ideal CMI system are: (a.) Reduce the amount of teacher time spent on routine record keeping chores (student records, achievement, progress reports, etc.), (b.) Supply the teacher with an electronic record keeping chart that is simple to update, maintain, and modify, (c.) Enhance and speed up the teacher's capabilities for diagnosis and prescription for each student in an individualized instructional setting, (d). Help the teacher plan and make decisions about the rate of instruction through the curriculum, and (e.) To supply the teacher with printed reports on virtually any reasonable aspect

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[6]. B.S. Bloom, J.T. Hastings, and G.F. Madaus, Handbook on Formative and Summative Evaluation of Student Learning, New York: McGraw Hill, 1971, 7-8.

pertaining to the student's performance. By using an 'ideal' CMI system, the teacher's instructional decision making will be greatly enhanced. Some minor decisions must be made by the CMI system to direct the student's progress in a particular direction but CMI cannot replace the teacher's perception of the student. The computer can only test the student in relation to the subject area studied, the way the student answered the questions, and then make a logical deduction, but the teacher can diagnose the student in many other ways (ie. student's behaviour outside of class, student's attitude, and other effecting environmental factors. Databases and CMI systems kept and maintained by principals on teachers and students would also be invaluable to higher level administrators (school district/board) for policy making and formulating goals and objectives for the future.

PART IV. RECOMMENDATIONS AND FUTURE

Computers will change one or more aspects of education compared to the traditional way or the way we have known it to exist. Therefore, educators at all levels (teachers, principals, and board administrators) must acknowledge the different modes of microcomputer use in the schools. A well designed CMI system could serve as the foundation for administrative tasks at the teacher and principal levels. It would be fast, efficient, accurate and reliable. It would also be able to provide priceless information to school board level administrators that would help them in creating long term goals, objectives, policies, etc.

CMI would be one of the most valuable assets to a school board that would not have a large number of computer phobic

educators. Some questions that should be asked by people in the field of education are: What are we doing now to plan for the computerized changing future? What different types of hardware can we use that will help us with management and administration next year or for the next five years? Since the factor of cost has been decreasing historically, we can expect it to decrease even more. The computing power or capability of a computer has been increasing with a decrease in physical size. Both of these factors make it inevitable that we as educators can't afford to be computer phobic nor to ignore valuable computer applications such as CMI, CAI, CBIS, CAL, etc.

Currently, according to (Willis et al,1983), most of the frustration and problems experienced by educators in the field of high level Computer Managed Instruction are a result of limitations in available software and hardware. He envisions a trend in the integration of CAI, CMI, and improved video and audio hardware components.

In the future, we must keep a conscious awareness on where we want the control of learning to be: student, computer, or teacher? If we wish to split the control among these three variables, we must decide how much should be allocated to each and why. We must also be objective and use evaluation methods similar to (Spuck and Bozeman,1980) to sift out the CMI system that meets all of our specified requirements. Possibly in the future, with the aid of Artificial Intelligence, a very complex, 'intelligent', and high level robotic CMI system will emulate a real teacher and be able to make subjective observations and

intuitive deductions.

Overall, a well designed CMI system in the future will certainly alleviate the teacher's problems related to individualized instruction, and generally create a better environment for the administrative chores of both principals and teachers.

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